C1

insulin activity, which compound possesses one or more ionic and hydrophobic chemical moieties spatially located so as to mimic the spatial location of at least an ionic or a hydrophobic amino acid residue of insulin, which amino acids are associated with the binding of insulin to its receptor. wherein said compound is an insulin receptor agonist

5. A method according to claim 1, wherein the non-peptidyl compound possesses ionic and hydrophobic chemical moieties spatially located so as to mimic ionic and hydrophobic residues associated with at least one of the following groups of amino acid residues:

(i.) A21 Asn, B21 Glu, A17 Glu, B24 Phe, B25 Phe;

(ii.) A21 Asn, B21 Glu, B24 Phe, B25 Phe;

(iii.) A21 Asn, B21 Glu, B24 Phe, B25 Phe, A1 Gly, A2 Ile, A3 Val;

(iv.) A21 Asn, B21 Glu, A17 Glu, A19 Tyr, A1 Gly, A2 Ile, A3 Val;

(v.) A21 Asn, B21 Glu, A17 Glu, B12 Val, A1 Gly, A2 Ile, A3 Val;

(vi.) A21 Asn, B21 Glu, B12 Val, A1 Gly, A2 Ile, A3 Val;

(vii.) A21 Asn, B21 Glu, A17 Glu, B16 Tyr, A1 Gly, A2 Ile, A3 Val;

C2

(viii) A21 Asn, B21 Glu, A17 Glu, A19 Tyr, B12 Val, B16 Tyr;

(ix.) A21 Asn, B21 Glu, A19 Tyr, B12 Val, B16 Tyr;

(x.) A21 Asn, B21 Glu, A17 Glu, B24 Phe, B25 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xi.) A21 Asn, B21 Glu, B24 Phe, B25 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xii) A21 Asn, B21 Glu, B24 Phe, B25 Phe, B12 Val, B16 Tyr;

(xiii.) A21 Asn, B21 Glu, A17 Glu, B24 Phe, B25 Phe, A19 Tyr;

(xiv.) A21 Asn, B21 Glu, B24 Phe, B25 Phe, A19 Tyr;

(xv.) A21 Asn, A17 Glu, B24 Phe, B25 Phe, A19 Tyr;

(xvi.) B21 Glu, A17 Glu, B24 Phe, B25 Phe, A19 Tyr;

(xvii.) A21 Asn, B21 Glu, A17 Glu, B24 Phe, B25 Phe, B12 Val;

(xviii.) A21 Asn, B21 Glu, B24 Phe, B25 Phe, B12 Val;

(xix.) A21 Asn, A17 Glu, B24 Phe, B25 Phe, B12 Val;

(xx.) B21 Glu, A17 Glu, B24 Phe, B25 Phe, B12 Val;

(xxi.) A21 Asn, B21 Glu, A17 Glu, B24 Phe, B25 Phe, B16 Tyr;

(xxii.) A21 Asn, B21 Glu, B24 Phe, B25 Phe, B16 Tyr;

(xxiii.) A21 Asn, A17 Glu, B24 Phe, B25 Phe, B16 Tyr;

(xxiv.) B21 Glu, A17 Glu, B24 Phe, B25 Phe, B16 Tyr;

(xxv.) A21 Asn, B21 Glu, A17 Glu, B24 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xxvi.) A21 Asn, B21 Glu, B24 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xxvii.)A21 Asn, A17 Glu, B24 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xxviii.) B21 Glu, A17 Glu, B24 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xxix.) A21 Asn, B21 Glu, A17 Glu, B25 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xxx.) A21 Asn, B21 Glu, B25 Phe, A19 Tyr, B12 Val, B16 Tyr;

(xxxi.) A21 Asn, A17 Glu, B25 Phe, A19 Tyr, B12 Val, B16 Tyr; or

(xxxii.)B21 Glu, A17 Glu, B25 Phe, A19 Tyr, B12 Val.

6. A method according to claim 1, wherein the non-peptidyl compound has the following formula:

$$AXYXZ_n \qquad \text{(formula 1)}$$

where A is W or VXW;

V is V_1 or V_2;

V is substituted with up to two X groups;

V_1 is a phenyl or 6 membered heteroaromatic ring, optionally substituted with up to 5 R_1 groups;

V_2 is a 5 member ring system which may incorporate up to 4 hetero atoms which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the ring system being optionally substituted with up to 4 R_1 groups;

W is W_1 or W_2 or W_3;

W is substituted with up to two X groups;

W_1 is V_1;

W_2 is a fused bicyclic ring system comprising rings of 5 or 6 atoms, which may incorporate up to 4 hetero atoms, which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the system being optionally substituted with up to seven R_1 groups;

W_3 is $-N(R_2)R'_2$;

R_1 is independently H, OH, alkyl, alkenyl, alkynyl, alkoxy, alkanol, hydroxyalkoxy, haloalkyl, haloalkoxy, halogen, SH, thioalkyl, cyano (-CN), $N(R_2)R'_2$, phenyl, phenyl optionally substituted with up to five alkyl groups of 1 to 3 carbon atoms or up to five halogen atoms, benzyl, phenethyl, nitro, $-COR_3$, $-R_5COR_3$, $-R_5SOR_3$, $-R_5SO_2R_3$, $-SO_2N(R_2)R'_2$ or azido;

R_2 and R'_2 are independently H, alkyl of 1 to 6 carbon atoms, alkenyl of 3 to 6 carbon atoms, alkynyl of 3 to 6 carbons, hydroxyalkyl of 2 to 6 carbons, alkoxy of 2 to 6 carbons, haloalkyl, haloalkenyl, haloalkoxy, benzyl, benzyl optionally substituted with up to four R_1 groups, phenylethyl, phenylethyl optionally substituted with up to four R_1 groups, arylalkyl, and where R_2 and R'_2 can also be joined to form cyclic structures;

C2

R_3 is independently H, OH, alkyl, alkenyl, alkynyl, alkoxy, alkanol, hydroxyalkoxy, $-R_4N(R_2)R'_2$, mesyl, triflouromesyl, $-NHSO_2CH_3$ or $-NHSO_2CF_3$;

R_4 is independently a bond, alkyl, alkenyl or alkynyl;

X is independently, a bond, $-R_4N(R_2)R_4-$, $-R_4N{=}NR_4-$, $-R_4N(R_2)-N(R_2)R_4-$, $-R_4OR_4-$, $-R_4SR_4-$, $-R_5-$, $-R_5O-$, $-R_5S-$, $-R_5N(R_2)-$, -SO-, sulfonyl ($-SO_2-$), -CO-, -CONH-, -NHCONH-, -NHCO-, -CONHCO-, $-CON(R_2)-$, $-R_5COR_5-$, $-R_5COR_5N(R_2)R_5-$, $-N(R_2)CO-$ or $-R_4N(R_2)R_4COR_4-$;

R_5 is independently alkyl, alkenyl, alkynyl, alkoxy, alkanol, hydroxyalkoxy;

Y is either Y_1, Y_2 or Y_3;

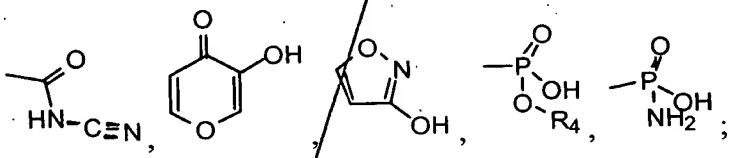
Y is substituted with at least two, but optionally up to four X linking groups;

Y_1 is a fused bicyclic ring system comprising rings of 5 or 6 atoms which may incorporate up to 4 hetero atoms, which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the ring system optionally independently incorporating a sulfoxide (SO), sulfone (SO_2) or carbonyl (CO) group and optionally up to seven R_1 groups;

Y_2 is a 6:6:6 or a 6:5:6 fused tricyclic system which may incorporate up to 4 hetero atoms which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the ring system optionally independently incorporating a sulfoxide (SO), sulfone (SO_2) or carbonyl (CO) group, and the ring system being substituted with at least two, but optionally up to four X linking groups and optionally up to seven R_1 groups;

Y_3 is V_1;

Z is independently $-R_6COOH$, $-R_6SO_3H$, $-R_6NO_2$, $-R_6SO_2H$, $-R_6SO_2NHR_2$; $-R_7SO_2NHCOR_4$ -N-trifluoromesylsulfonamidate, -OH, -2-yl-hydroxyethanoic acid (-CH(OH)COOH), -3-yl-2-hydroxypropanoic acid ($-CH_2CH(OH)COOH$) -2-yl-2-hydroxypropanoic acid ($-CH(CH_3)(OH)COOH$), -3-yl-2,3-dihydroxypropanoic acid (-CH(OH)CH(OH)COOH),-2-yl-2,3-dihydroxypropanoic acid(-$C(CH_2(OH))(OH)COOH$), -3-yl-2-hydroxypropan-3-one-1-oic acid (-$COCH(OH)COOH$, 2-yl-2-hydroxypropandioic acid (-C(COOH)(OH)COOH), -2-yl-propandioic acid (-C(COOH)(H)COOH), -4-yl-2-hydroxybutan-4-one-1-oic acid ($-COCH_2CH(OH)COOH$, 2-yl-2-hydroxybutan-1,4-dioic acid (-$C(OH)(COOH)CH_2COOH$), 3-yl-2-hydroxybutan-1,4-dioic acid (-CH(CH(OH)COOH)COOH), 5-yl-tetrazole,



R_6 is independently a bond, alkyl, alkenyl, alkynyl, alkoxy, $-CO(CH_2)_n-$, where n is an integer between 0 and 4, alkanoic, alkenoic or alkynoic;

with the exception that where W_1 is an optionally substituted phenyl then Y_1 cannot be an optionally substituted phenyl.

11. A pharmaceutical composition comprising at least a chemical compound capable of modulating the biological activity of insulin, and a second composition selected from the group consisting of a pharmaceutically acceptable carrier, a diluent, and combinations thereof; wherein said compound has the following general formula.

$$AXYXZ_n \qquad \text{(formula 1)}$$

where A is W or VXW;

V is V_1 or V_2;

V is substituted with up to two X groups;

V_1 is a phenyl or 6 membered heteroaromatic ring, optionally substituted with up to 5 R_1 groups;

V_2 is a 5 member ring system which may incorporate up to 4 hetero atoms which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the ring system being optionally substituted with up to 4 R_1 groups;

W is W_1 or W_2 or W_3;

W is substituted with up to two X groups;

W_1 is V_1;

W_2 is a fused bicyclic ring system comprising rings of 5 or 6 atoms, which may incorporate up to 4 hetero atoms, which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the system being optionally substituted with up to seven R_1 groups;

C 3

W_3 is $-N(R_2)R'_2$;

R_1 is independently H, OH, alkyl, alkenyl, alkynyl, alkoxy, alkanol, hydroxyalkoxy, haloalkyl, haloalkoxy, halogen, SH, thioalkyl, cyano (-CN), $N(R_2)R'_2$, phenyl, phenyl optionally substituted with up to five alkyl groups of 1 to 3 carbon atoms or up to five halogen atoms, benzyl, phenethyl, nitro, $-COR_3$, $-R_5COR_3$, $-R_5SOR_3$, $-R_5SO_2R_3$, $-SO_2N(R_2)R'_2$ or azido;

R_2 and R'_2 are independently H, alkyl of 1 to 6 carbon atoms, alkenyl of 3 to 6 carbon atoms, alkynyl of 3 to 6 carbons, hydroxyalkyl of 2 to 6 carbons, alkoxy of 2 to 6 carbons, haloalkyl, haloalkenyl, haloalkoxy, benzyl, benzyl optionally substituted with up to four R_1 groups, phenylethyl, phenylethyl optionally substituted with up to four R_1 groups, arylalkyl, and where R_2 and R'_2 can also be joined to form cyclic structures;

R_3 is independently H, OH, alkyl, alkenyl, alkynyl, alkoxy, alkanol, hydroxyalkoxy, $-R_4N(R_2)R'_2$, mesyl, triflouromesyl, $-NHSO_2CH_3$ or $-NHSO_2CF_3$;

R_4 is independently a bond, alkyl, alkenyl or alkynyl;

X is independently, a bond, -$R_4N(R_2)R_4$-, -$R_4N{=}NR_4$-, -$R_4N(R_2)$-$N(R_2)R_4$-, -R_4OR_4-, -R_4SR_4-, -R_5-, -R_5O-, -R_5S-, -$R_5N(R_2)$-, -SO-, sulfonyl (-SO_2-), -CO-, -CONH-, -NHCONH-, -NHCO-, -CONHCO-, -$CON(R_2)$-, -R_5COR_5-, -$R_5COR_5N(R_2)R_5$-, -$N(R_2)CO$- or -$R_4N(R_2)R_4COR_4$-;

R_5 is independently alkyl, alkenyl, alkynyl, alkoxy, alkanol, hydroxyalkoxy;

Y is either Y_1, Y_2 or Y_3;

Y is substituted with at least two, but optionally up to four X linking groups;

Y_1 is a fused bicyclic ring system comprising rings of 5 or 6 atoms which may incorporate up to 4 hetero atoms, which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the ring system optionally independently incorporating a sulfoxide (SO), sulfone (SO_2) or carbonyl (CO) group and optionally up to seven R_1 groups;

C5

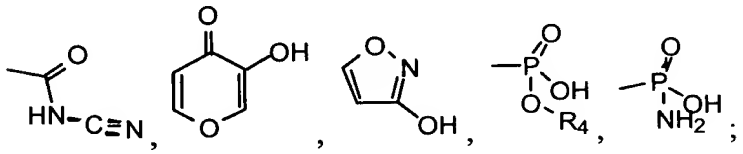
Y_2 is a 6:6:6 or a 6:5:6 fused tricyclic system which may incorporate up to 4 hetero atoms which may be independently a nitrogen atom, a nitrogen atom optionally substituted with R_2, oxygen or sulfur, the ring system optionally independently incorporating a sulfoxide (SO), sulfone (SO_2) or carbonyl (CO) group, and the ring system being substituted with at least two, but optionally up to four X linking groups and optionally up to seven R_1 groups [and thus examples include, but are not limited to 9H-xanthone, 9H-xanthene, phenoxathaiin, phenoxathiin-10-oxide, phenoxathiin-10-dioxide, acridine, phenazine, phenothiazine, phenoxazine, phenothiazine-5-oxide, phenothiazine-5-dioxide, thiathrene-5-dioxide, thiathrene-5-oxide, carbazole, dibenzo[b,d]furan, dibenzo[b,d]thiophene];

Y_3 is V_1;

Z is independently -R_6COOH, -R_6SO_3H, -R_6NO_2, -R_6SO_2H, -$R_6SO_2NHR_2$; -$R_7SO_2NHCOR_4$ -N-trifluoromesylsulfonamidate, -OH, -2-yl-hydroxyethanoic acid (-CH(OH)COOH), -3-yl-2-hydroxypropanoic acid (-$CH_2CH(OH)COOH$) -2-yl-2-hydroxypropanoic acid (-$CH(CH_3)(OH)COOH$), -3-yl-2,3-dihydroxypropanoic acid (-CH(OH)CH(OH)COOH), -2-yl-2,3-dihydroxypropanoic acid (-$C(CH_2(OH))(OH)COOH$), -3-yl-2-hydroxypropan-3-one-1-oic acid (-COCH(OH)COOH, 2-yl-2-hydroxypropandioic acid (-C(COOH)(OH)COOH), -2-yl-propandioic acid (-C(COOH)(H)COOH), -4-yl-2-hydroxybutan-4-one-1-oic acid

(-$COCH_2CH(OH)COOH$, 2-yl-2-hydroxybutan-1,4-dioic acid (-$C(OH)(COOH)CH_2COOH$), 3-yl-2-hydroxybutan-1,4-dioic acid (-$CH(CH(OH)COOH)COOH$), 5-yl-tetrazole,

C3



R_6 is independently a bond, alkyl, alkenyl, alkynyl, alkoxy, $-CO(CH_2)_n-$, where n is an integer between 0 and 4, alkanoic, alkenoic or alkynoic;

with the exception that where W_1 is an optionally substituted phenyl then Y_1 cannot be an optionally substituted phenyl.

18. (Cancelled)

19. (Cancelled)

20. A method according to claim 6 wherein V_1 is selected from the group: benzene, pyridine, pyridazine, pyrimidine, pyrazine, triazine.

21. A method according to claim 6 wherein V_2 is selected from the group: cyclopenta-1,3-diene, pyrrole, furan, thiophene, oxazole, isoxazole, pyrazole, imidazole, thiazole, isothiazole or triazole, optionally substituted with up to 4 R_1 groups.

C4

22. A method according to claim 6 wherein W_2 is selected, from the group: naphthalene, quinoline, isoquinoline, phthalazine, naphthyridine, quinoxaline, quinazoline, cinnoline, pteridine, indole, benzothiophene, benzofuran, benzimidazole, indazole, benzoxazole, benzisooxazole, benzthiazole, benzisothiazole, purine, indoline, isoindoline.

23. A method according to claim 6 wherein R_2 and R'_2 are joined to form cyclic structures selected from the group: pyrrolidine, piperidine, hexahydro-1H-azepine, morpholine or piperazine.

24. A method according to claim 6 wherein Y_1 is selected from the group: croman, isochroman, benzofuran, cromene, 1,2,3,4-tetrahydronaphthalene, 1,4-dihydronaphthalene, indan, indene, benzopiperidine, indoline, isoindoline, quinoline, isoquinoline, phthalazine,

naphthyridine, quinoxaline, quinazoline, cinnoline or pteridine, coumarin or 2,3-dihydrocoumarin.

25. A method according to claim 6 wherein Y_2 is selected from the group: 9H-xanthone, 9H-xanthene, phenoxathiin, phenoxathiin-10-oxide, phenoxathiin-10-dioxide, acridine, phenazine, phenothiazine, phenoxazine, phenothiazine-5-oxide, phenothiazine-5-dioxide, thiathrene-5-dioxide, thiathrene-5-oxide, carbazole, dibenzo[b,d]furan, dibenzo[b,d]thiophene.

26. A pharmaceutical composition according to claim 11 wherein V_1 is selected from the group: benzene, pyridine, pyridazine, pyrimidine, pyrazine, triazine.

27. A pharmaceutical composition according to claim 11 wherein V_2 is selected from the group: cyclopenta-1,3-diene, pyrrole, furan, thiophene, oxazole, isoxazole, pyrazole, imidazole, thiazole, isothiazole or triazole, optionally substituted with up to 4 R_1 groups.

C14

28. A pharmaceutical composition according to claim 11 wherein W_2 is selected, from the group: naphthalene, quinoline, isoquinoline, phthalazine, naphthyridine, quinoxaline, quinazoline, cinnoline, pteridine, indole, benzothiophene, benzofuran, benzimidazole, indazole, benzoxazole, benzisooxazole, benzthiazole, benzisothiazole, purine, indoline, isoindoline.

29. A pharmaceutical composition according to claim 11 wherein R_2 and R'_2 are joined to form cyclic structures selected from the group: pyrrolidine, piperidine, hexahydro-1H-azepine, morpholine or piperazine.

30. A pharmaceutical composition according to claim 11 wherein Y_1 is selected from the group: croman, isochroman, benzofuran, cromene, 1,2,3,4-tetrahydronaphthalene, 1,4-dihydronaphthalene, indan, indene, benzopiperidine, indoline, isoindoline, quinoline, isoquinoline, phthalazine, naphthyridine, quinoxaline, quinazoline, cinnoline or pteridine, coumarin or 2,3-dihydrocoumarin.

31. A pharmaceutical composition according to claim 11 wherein Y_2 is selected from the group: 9H-xanthone, 9H-xanthene, phenoxathiin, phenoxathiin-10-oxide, phenoxathiin-10-dioxide, acridine, phenazine, phenothiazine, phenoxazine, phenothiazine-5-oxide,